Ameren Illinois
2nd Quarter 2015 Smart Grid Test Bed Report

August 14, 2015

Table of Contents

Executive Summary

Ameren Illinois Company (Ameren Illinois) submits the following Smart Grid Test Bed Quarterly Report in accordance with the Energy Infrastructure Modernization Act (EIMA), 220 ILCS 5/16-108.5 et seq. This report provides updates on the steps Ameren Illinois has taken to implement its test bed plan during the first quarter of 2015. The report includes information on activities Ameren Illinois has undertaken to further develop its "primary" test bed location, discussions with potential test bed customers, and on the testing application process.

DOE Funding Opportunity Projects

Technology Applications Center (TAC) personnel continue their work on the following DOE funded projects. Work continues on creation of test plans as well as review of each project solutions design.

- **(ARMORE)** - Applied Resiliency for More Trustworthy Grid Operation

  Primary Investigator – Grid Protection Alliance
  Partners – University of Illinois – Urbana/Champaign (UIUC), Pacific Northwest National Laboratory

  An open-source system that can perform inspection of network packets and alarms on communication that does not comply with the specified ARMORE policy. ARMORE will be configured to take action to block network traffic based on deep inspection of common substation communications protocols, such as DNP3.

  Ameren Illinois did not engage with this Primary Investigator during this reporting period.

- **(CODEF)** - Collaborative Defense of Transmission and Distribution Protection and Control Devices Against Cyber Attacks

  Primary Investigator – ABB
  Partners – UIUC

  This project will advance the state of the art for cyber defense methods for transmission and distribution grid protection and control devices by developing and demonstrating a distributed security domain layer that enables transmission and protection devices to collaboratively defend against cyber-attacks in an IEC 61850 environment.

  Technology Applications Center and Ameren Illinois relay department employees provided training to UIUC researchers on how to functionally test relays. This included how to properly inject voltage and current into relays under test to simulate fault conditions. The Technology Applications Center staff also loaned its Doble Relay Test Set to UIUC researchers for possible use with UIUC's Real Time Digital Simulator Unfortunately, UIUC

researchers were unable to utilize the loaned relay test set due to licensing issues associated with relay test set.

Ameren Illinois personnel from the Technology Applications Center as well Ameren's Information Technology Cyber Security department participated in the June 23, 2015 CODEF project review meeting in Raleigh, North Carolina. Representatives from each project member organization as well as the DOE project sponsors, Carol Hawk & Ron Staubly were in attendance. Don Borries presented a slide deck that describes the TAC's equipment and testing capabilities.

- **(PBCONF)** – Secure Policy-Based Configuration Framework

  Primary Investigator: Electric Power Research Institute (EPRI)
  Partners –UIUC, Schweitzer Engineering Laboratories

  An extensible, policy-based configuration framework to support the secure configuration and remote access of modern and legacy devices from a variety of vendors. The open-source framework will combine a policy engine with a translation engine to address the interoperability challenges of various remote access control methods and provide utilities with a single, organization-wide view of the security configuration for their power delivery devices.

  Ameren Illinois personnel continue to work with project member representatives to identify test plan activities as well as testing platforms for this solution. Also reconfiguration of a portion of the TAC communications network was performed to enable alpha project testing of the solution which is scheduled to commence in 3rd Quarter 2015.

- **(SDN)** – Software-Defined Networking

  Primary Investigator: Schweitzer Engineering Laboratories
  Partners –UIUC, Pacific Northwest National Laboratory

  SDN allows a programmatic change control platform, which allows the entire network to be managed as a single asset, simplifies the understanding of the network, and enables continuous monitoring in more detail. Control system networks are often more static, while the corporate world is more dynamic.

  Ameren Illinois personnel participated in bi-weekly conference calls to learn about the project member's testing activities and equipment testing requirements. TAC personnel are now awaiting delivery of the SDN load flow controller and associated hardware that will be necessary to establish the TAC testing infrastructure for this project. Ameren Illinois personnel reviewed project status reports that will be submitted to the Department of Energy. Ameren personnel assisted the SDN team in presenting a paper titled "Simplifying your Substation LAN with Software-Defined Network" at the 2015 UTC – Telecom & Technology conference.

Other Current Test Bed Projects

- Ameren Illinois continues to evaluate new LED lighting technology by measuring and collecting data through use of the TAC infrastructure. TAC personnel as well as Ameren Innovation Center student workers completed phase III testing of the LED lights during this reporting cycle. Phase III testing included cycling of the LED lights through an on and off cycle for approximately 5500 cycles. (Test designed to approximate 15 years of service life). TAC personnel and Ameren Innovation Center student workers also worked on developing the phase IV testing requirements which will enable lumen testing of each of the nine LED lights from six vendors across a geometric grid that has been established at the TAC. The LED lumen testing will be compared to testing results for a 100 watt sodium vapor light which produces an approximately equivalent light output to the LED lights. The data being collected will be utilized to determine if the roadway LED's are recommended for a future Ameren Illinois lighting tariff offering.

- Ameren Illinois finalized its Smart Device validation program that will allow Ameren Illinois to determine the functionality and operability of how end use devices interface with Ameren Illinois's AMI meters. TAC personnel began testing of one manufacturer's in-home-display and gateway smart devices, during this reporting cycle. Ameren Illinois also contacted five vendors that expressed interest in having their smart devices tested by Ameren Illinois during the 2015 Distributech conference and informed them that Ameren Illinois was now ready to begin smart device testing.

- EPRI's Field demonstrations of the ANSI/CEA-2045 Modular Communication Interface Standard – Four field demonstration devices (Controllable Thermostat, Hot Water Heater, Pool Pump, and Electric Vehicle Supply Charger) are presently being produced by research partner vendors to enable demand response testing of devices utilizing the modular socket communications platform. Ameren Illinois understands that delivery of the field demonstration devices will occur during the 3rd quarter of 2015 and is establishing plans to test these devices at the TAC once the devices are made available.

- TAC staff was introduced to a Cybersecurity and Compliance Solutions vendor who has been awarded a Department of Energy Grant to develop a patch and update management program for Industrial Control Systems. TAC staff continues to work with the vendor to become a utility partner in this research initiative.

Test Bed Applications

- Ameren Illinois continues to work with an Energy Storage System Integrator for the installation of a battery storage system. Ameren Illinois has reviewed several substation locations and provided the applicant with a possible location where a 5MW energy storage system could be deployed. Contact with this applicant revealed that they are reviewing the suggested substation locations as well as conducting research with adjacent property owners to the substations in order to develop a possible project location.

- TAC staff learned that the applicant who proposed to utilize the TAC testing process for their new concentrated solar panel system no longer wishes to utilize the TAC testing process for their device. The applicant decided on an alternative approach and now believes t their product can now be classified as a commercially viable product.

Industry Participation

On April 7th and April 21st, Technology Applications Center staff presented a TAC presentation to members attending the Electrical Board of Illinois – Missouri in Mt. Vernon and Springfield, Illinois.

On May 8th, Technology Applications Center staff presented a TAC presentation to attendees of UIUC's annual Power Affiliates Program in Champaign, Illinois. The Power Affiliates Program was established in 1979 to establish a linkage between industry and academia to strengthen the power and energy programs that are offered by UIUC's Electrical and Computer Engineering department. The annual program is attended by engineers from both industry and academia, to share the results of research being performed by UIUC students.

TAC staff worked with UIUC professors of aeronautical engineering in their development of a National Science Foundation grant application to fund Unmanned Aerial Vehicle (UAV) research. This proposal includes use of the TAC electric distribution system infrastructure to enable testing of the UAV technology.

Test Bed Tours

- On June 4, 2015, TAC staff provided a tour of the Technology Applications Center to representatives of a Cybersecurity and Compliance Solutions vendor who has been awarded a Department of Energy grant to develop a patch and update management program for Industrial Control Systems.

- On June 8, 2015, TAC staff provided a tour to six internal Ameren Engineers.

Smart Grid Test Bed Plan Success

Ameren Illinois' commitment to the successful implementation of its Smart Grid Test Bed plan is strong. However, as set forth above, Ameren Illinois reserves the right to modify, amend or alter this plan, as necessary and consistent with the law, to meet the requirements and objectives of the EIMA and other related provisions. Additionally, Ameren Illinois reserves its right to terminate this plan.